

Space News Roundup

Feds approve NASA Road 1 widening

State expects construction start after new visitors center opens

Preliminary plans for widening NASA Road 1 have been completed by Texas highway officials, but construction is not expected to begin until after the scheduled opening of the new JSC visitors center in 1991.

Janelle Gbur, a spokeswoman for the Texas Department of Highways and Public Transportation, said public hearings are expected to be announced in the near future as

soon as right-of-way discussions with the City of Webster are finished. Design schematics and environmental assessments have been approved by the Federal Highway Administration, she said.

Gbur said plans call for construction of a new interchange at I-45, and widening of NASA Road 1 to six lanes between I-45 and Highway 3, to eight lanes from Highway 3 to

Space Center Blvd., and to six lanes from Space Center Blvd. to Highway 146. There will be overpasses at Highway 3 and El Camino Real, she said, and the NASA Road 1 roadbed will be raised to improve its usefulness as an evacuation route.

The highway department tentatively plans to award contracts for three separate projects in September 1992, she said. Construction

activity would begin about 60 days after the contracts are awarded, and it would take about three years to complete all of the work, she added.

The new visitors center is expected to draw 2 to 3 million visitors annually and significantly increase traffic along NASA Road 1, said Harold Stall, president of the Manned Space Flight Education Foundation which is preparing to

build the visitor facilities.

The NASA Road 1 project is part of the state's 10-year project development plan and will be reprioritized each time that plan is adjusted. Gbur said projected traffic volumes may affect those rankings.

Grady McCright, chairman of the Foundation's operations oversight committee, said the Manned Space

(Continued on page 2)



JSC Photo

Cameramen for CBS-TV's "48 Hours" program record the activities of flight controllers in the Mission Control Center during the recent STS-26 long-duration simulation.

Long sim builds confidence

The lead flight director for the recent STS-26 long-duration simulation says the exercise was a fast paced, comprehensive confidence builder.

"I think it was an excellent sim," said Flight Director Larry Bourgeois. "The simulation folks put together a good script which exercised the MCC (Mission Control Center) as well as the Sunnyvale flight control team responsible for the IUS (Inertial Upper Stage) and the TDRS (Tracking and Data Relay Satellite) flight control team at White Sands."

"It gives us confidence that after the two-year standdown we still have the expertise in place, the processes in place, and that the players can work together to accomplish objectives as a team," he said.

Bourgeois said the simulation was fast paced, but that failures were injected in such a way that the flight control teams could evaluate them in depth and respond in detail.

Stokes McMillan, lead simulation supervisor, said 80 to 100 malfunctions were inserted during the course of the 32-hour sim.

Bourgeois said the toughest part of the exercise was when a combination of problems delayed simulated deployment of the TDRS. The problems gave the flight control teams in the MCC, Sunnyvale and White Sands a workout in interactive replanning.

The presence of television crews from CBS "48 Hours" did not affect the flow of operations or the quality of the simulation, he said.

Crews responsible for maintaining the MCC and the Shuttle Mission Simulator did an outstanding job of ensuring that they worked and performed during the mission in spite of the many modifications under way during the standdown, he said.

"We had a good well-balanced exercise of the team," said STS-26 Commander Rick Hauck. "I think it shows that we're well on the way to being fully ready for STS-26 launch."

Shuttle managers choose safer pole for crew escapes

A telescoping pole will be the egress method for the Space Shuttle's new crew escape system, and will be incorporated into *Discovery* prior to STS-26 in August.

The selection of the telescoping pole, over an alternative tractor rocket extraction system, was made at NASA Headquarters by National Space Transportation System Director Arnold Aldrich following a review of system design, test performance and flight hardware status.

"The NASA-contractor team has done a fantastic job in providing both the tractor rocket and telescoping pole systems to support the next Shuttle flight," Aldrich said. "The telescoping pole was selected as it has shown to be safer, simpler to operate, lighter weight and easier to support than the tractor rocket system, while meeting all escape system performance requirements."

The telescoping pole, designed and manufactured at JSC, is made of lightweight aluminum and steel and weighs 241 pounds. It is about 70 pounds lighter than the tractor rockets system. The rockets also have a five-year operational shelf life limitation and additional processing requirements between flights.

Tests conducted in February and March, using a fixed pole extending through a hatch-like opening in a C-141 aircraft, demonstrated that the pole would provide adequate Orbiter clearance.

Navy parachutists, approximating the sizes of astronauts from the smallest to the largest, completed 66 jumps using a lanyard attached to their parachute harness to slide down the pole and descend to a safe landing.

The pole housing attaches to the Orbiter's middeck ceiling and is 126.75 inches long. The primary

extension is 112.54 inches (arched length), and the end extension is 32.65 inches.

For launch and landing, the unextended pole will be oriented toward the closed crew hatch. During on-orbit operations, the pole will be repositioned toward the middeck lockers and stowed on the ceiling so as not to interfere with flight crew activities.

This decision completes the crew escape system package. Already approved and implemented are the Orbiter primary crew hatch jettison capability and crew support equipment—a partial pressure suit, oxygen equipment, a parachute, a life raft and survival equipment for each crew member.

The escape system provides crew escape capability from the Orbiter during controlled, gliding flight following failures or difficulties during ascent or entry where landing at a suitable landing field cannot be achieved.

Meanwhile, stacking of the solid rocket motor (SRM) segments for STS-26 has begun at Kennedy Space Center, but turbopump inspections on the main flight engines have used up all contingency time for the Aug. 4 internal launch target.

Jay Honeycutt, deputy manager of the NSTS Program Office at JSC, said the high-pressure liquid oxygen (LOX) turbopump inspections began after inspectors tearing down two engines on test stands noticed that screws which hold down one of the pump's seals were loose.

After the discovery, program officials decided to inspect the STS-26 flight engines, as well. The problem was not present on the first of the three pumps, he said, and inspections were under way on the other two.

Myers, Truly to present NASA Honor Awards

Fifty-six JSC employees and one group will receive NASA Honor Awards for outstanding contributions to the activities of the agency at a Wednesday ceremony in the Bldg. 2 Teague Auditorium.

NASA Deputy Administrator Dale Myers and Rear Adm. Richard Truly, NASA associate administrator for space flight, will present the awards with the help of JSC Director Aaron Cohen and JSC Deputy Director Paul J. Weitz.

The awards ceremony follows a March 15 presentation at NASA Headquarters, where NASA Distin-

guished Service Medals were bestowed upon Henry W. Hartsfield Jr. and Weitz. Cohen, Robert L. Crippen and Jay F. Honeycutt received NASA Outstanding Leadership Medals at that ceremony, and Manley L. Carter Jr., Daniel M. Germany, Tommy W. Holloway, James B. Jackson and Joseph P. Kerwin, M.D., received NASA Exceptional Service Medals.

Medals to be presented at the 3 p.m. Wednesday ceremony include:

★ **NASA Outstanding Leadership Medal**—Daniel C. Brandenstein, Robert L. Gibson, William R.

Kelly and Brewster H. Shaw Jr.;

★ **NASA Exceptional Scientific Achievement Medal**—Nitza M. Cinton, M.D.;

★ **NASA Exceptional Engineering Achievement Medal**—George D. Nelson, Ph.D., James A. Smith Jr., William E. Thornton Jr., M.D.;

★ **NASA Exceptional Service Medal**—Robert L. Blount, Charles F. Bolden Jr., Vance D. Brand, James F. Buchli, Franklin R. Chang-Diaz, Ph.D., Gil Chisholm Jr., Mary L. Cleave, Ph.D., James L. Cole, John O. Creighton, Patrick M. Duffin,

Bonnie J. Dunbar, Ph.D., Elsie M. Easley, Eugene G. Edmonds, Anthony W. England, Ph.D., Anna L. Fisher, M.D., William F. Fisher, M.D., Jerry R. Goodman, Ronald J. Grabe, S. David Griggs, Steven A. Hawley, Ph.D., David C. Hilmers, Jeffrey A. Hoffman, John D. Hold, Nickolas Jervas, Daniel L. Knight, John P. Kochner;

Cheever H. Lambert Jr., David C. Leestma, James L. Lewis Jr., John K. Lottinville, John M. Lounge, Shannon W. Lucid, Ph.D., Richard E. Mayo, James B. McCaulley, F. Story Musgrave, M.D., Steven R.

Nagel, Bryan D. O'Connor, Robert A.R. Parker, Ph.D., Edward L. Pavelka Jr., Jerry L. Ross, Margaret R. Seddon, M.D., Sherwood C. Spring, Kathryn D. Sullivan, Ph.D., Leslie J. Sullivan, Norman E. Thagard, M.D., Donald E. Williams, and Roger C. Zwiag;

★ **NASA Public Service Medal**—Robert B. Young, Lockheed Engineering and Management Services Inc.; and

★ **NASA Group Achievement Award**—Space Station Thermal Test Bed Team.

People

Apollo 20th anniversary celebration planned July '89

Joe McKenzie, Patsy Hall and Barbara Perkins are organizing an Apollo Spacecraft Program Office (ASPO) reunion in celebration of the upcoming 20th anniversary of the Apollo 11 lunar landing. The reunion is planned for July 1989. ASPO Alumni who are interested in contributing to the planning of the reunion should contact McKenzie, x30157; Hall, x30824; or Perkins, x34173.

McDonnell Douglas makes staff changes

Alan B. Kehlet recently was appointed McDonnell Douglas' vice president and general manager for Space Transportation. Kehlet had been general manager for Tomahawk Weapon Systems. He has also served in senior management positions with Rockwell International on the Apollo and Space Shuttle Programs and has commercial experience as president of Rockwell's Sabertliner Division. Kehlet succeeds Charles J. DaRos, who is retiring. Don V. Magill will be Kehlet's deputy general manager.

Bulletin Board

Macintosh Users meeting scheduled April 4

The next NASA Area Macintosh Users (NAMU) meeting will be at 7 p.m. April 4 at 600 Gemini, RSOC cafeteria. There will be hardware and software demonstrations, questions and answers, public domain software, special interest groups and help for new users.

Fairchild to address Space Society on April 14

The Clear Lake Area Space Society (CLASS) will hold its next meeting at 7:30 p.m. April 14 at the Gilruth Center, Rm. 207. Kyle Fairchild will be the keynote speaker. For more information call Chuck DiFalco, x31701.

Get you dancin' shoes ready for April 16

The JSC-EAA will sponsor a ballroom dance from 9 p.m. to 1 a.m. April 16 at the Gilruth Center. Social hour is planned from 7 to 8 p.m. and dinner will be served from 8 to 9 p.m. Music will be supplied by the Dave Berry Combo. Tickets will be on sale through 2 p.m. April 13 in the Bldg. 11 Exchange Store.

Foreign language classes at UH-CL begin April 18

Non-credit foreign language classes in French, German, and Russian will be offered at the University of Houston—Clear Lake beginning April 18. Classes will meet once a week for 1 1/2 hours for seven weeks ending June 3. Cost is \$92 for new students and \$89 for returning students. For more information or registration materials call 488-9315.

AIAA hosts lunch and learn meeting April 20

Steve Scheer and Brian Rochon of LEMSCO will present a "Summary of Orbiter and Space Station Mating Simulations" at the next AIAA Materials, Structures and Dynamics Technical Committee's lunch and learn meeting from 11:30 a.m. to 12:30 p.m. April 20 in Lockheed Plaza 1, Rm. 22C. For more information call Don Thomas, x36459, or Don Probe, 333-6278.

NSTS Regatta sets sail again April 20

The seventeenth running of the NSTS Regatta will begin at 1:30 p.m. April 20 in Galveston Bay. The field now contains 19 sailboats. Additional entries will be accepted until race day; there is no entry fee. Anyone interested in competing should call Norm Talbott, x36877.

Amiga computer users to meet April 21

The next meeting of Amiga enthusiasts will be at 7 p.m., April 21 at 600 Gemini, RSOC cafeteria. New members are encouraged to bring their questions and watch demonstrations of new hardware and software.

"Goodnight Texas" benefit show is April 22

A benefit presentation of "Goodnight Texas" at 8 p.m. April 22 in the University of Houston—Clear Lake's Satellite Theater will raise funds for the American Business Women's Association scholarship fund. Tickets are \$10 each. For more information, call Nancy Gabriel, x32886.

Vintage Radio Association plans annual show April 23-24

Houston Vintage Radio Association will hold its ninth annual show and auction on April 23 and 24 at the Sheraton Kings Inn on NASA Road 1. For display schedule information call Dave Moore, x38937.

Bay Area PC Organization to meet April 26

The next Bay Area PC Organization (BAPCO) meeting is planned for 7:30 p.m. April 26 at League City Bank & Trust. The keynote speaker will discuss "Recent Advances in Hardware." For more information, call Earl Rubenstein, x34807.

Bay area officers' wives meet April 26

The Bay Area Military Officers' Wives Club will meet at 11 a.m. April 26 at the Gilruth Recreation Center. Sakowitz will present a fashion show during lunch. Lunch reservations must be made by noon April 21. For more information or to make reservations, call Mae Nickerson, 337-1054.

'Back to the Future' JSC picnic set for May 7

A "Back to the Future" JSC picnic is planned from 11 a.m. to 5 p.m. May 7 at the Gilruth Center. Barbecue dinner will be served between noon and 3 p.m. New this year will be a petting zoo and mime theater. Other activities include the dunk tank, bingo, water balloon toss, horse shoe tournament and Almost Anything Goes. The band will be 4th Wave Rhythm. Tickets may be purchased through May 4 at the JSC Exchange Store located in Bldg. 11.

JSC runners participate in regional track meet on May 14

JSC runners will participate in the Houston Corporate Athletic Association regional track meet on May 14 at Texas Southern University. Anyone interested in joining the track team should contact Patrick Chimes, x32397.

Gilruth Center News

Call x30304 for more information

EAA badges—Dependents and spouses may apply for photo I.D. badges April 12 or 26 between 6:30 and 8:30 p.m.

Defensive driving—Course is offered May 21 from 8 a.m. to 5 p.m. and costs \$20.

Weight safety—This is a required course for those employees wishing to use the Rec Center weight room. The class will be on April 21 or May 4. Cost is \$4.

Softball Tournament—NASA Men's C Invitational & Men's Open B tournament will be April 23. Entry fee is \$95; entry deadline is April 20.

Scuba—Scuba classes begin April 11 and meet every Monday and Wednesday from 7 to 9 p.m. for six weeks. Initial fee is \$45 and \$80 will be due at the first class.

Almost Anything Goes—Six coed teams are needed Saturday, May 7 at the JSC employee picnic. Teams consist of three men and three women. Entry fee is \$10; entry deadline is April 29. Every team member will receive a T-shirt.

New Mission Evaluation Room ready

The new Mission Evaluation Room (MER) in Bldg. 30 is ready for business, according to Joe Mechelay, manager of the Flight Data and Evaluation Office.

JSC workers got a chance to see the new MER during a March 23 open house.

Mechelay said the MER was moved from Bldg. 45 to meet security requirements for supporting Department of Defense Shuttle missions and to permit growth when

a new flight control system is implemented.

The MER provides pre- and post-launch engineering support and mission support to the Mission Control Center, he said. The MER's role begins 24 hours before launch, when its team of engineers helps evaluate any launch commit criteria violations. A total of about 120 people staff the MER during pre-launch and entry; 20 to 50 people work there during the rest of the

mission. If problems arise during the mission, MER personnel may be called in to evaluate the situation and recommend a course of action, he said.

New equipment was added during the move, including Masscomp work stations that can manipulate real-time or playback flight data, a Shuttle Software Processing Facility interface, and a launch processing system that can monitor data from Kennedy Space Center.



JSC Photo
Planetary scientist Faith Vilas studies orbital debris in her Bldg. 31 office.

Asteroid is namesake

By Beverly Green

One small heavenly body discovered between Mars and Jupiter recently was named Vilas in honor of JSC planetary scientist Faith Vilas. The recognition places Vilas' name among an elite group of immortals.

"Only 3,000 asteroids have been discovered," said Ted Bowell, a Lowell Observatory astronomer who nominated Vilas for the honor. "Vilas has done a lot of interesting work over the years and has made good contributions to space sciences."

"Not many people receive the honor because there is a strict committee that reviews nominations and discoverers can also choose to name the asteroid after a city or country," said Bowell, who has discovered 200 asteroids.

It is an unwritten rule that discoverers do not name their discoveries after themselves. Every three months, the International Astronomical Union, composed of a subcommittee of four international scientists, reviews discoverers' proposals for asteroid names.

One of Vilas' contributions, cited in February issue of the *Minor Planet Circulars*, was her design of the coronagraph/spectrograph used to image the planetary disk around Beta Pictoris, a star 50 light years from Earth. The disk was the first of its kind to be seen clearly in astronomical photographs. Vilas designed and built the instrument as part of her doctoral dissertation at the University of Arizona.

Since Vilas joined JSC's Solar System Exploration Division her work has been devoted primarily to evaluating the hazard presented by Earth-orbiting debris for future manned missions, including NASA's Space Station.

Barrios Technology gets mission support engineering contract

Barrios Technology Inc., Houston, has been awarded a five-year, \$10,991,000 cost-plus-award-fee contract to perform technical support to JSC's Mission Support Directorate.

All work under the Production Engineering and Information Management Support Contract will be performed at JSC and include technical support to a broad range of Mission Support Directorate tasks related to the National Space Transportation System (NSTS), Space Station and institutional programs and projects.

Other bidders were Network Solutions Inc. and Omniplan Corp., both of Houston.



JSC Photo by Benny Benavides
CONTRACT SIGNING—JSC Director Aaron Cohen and Robert Bryant, president of the American Federation of Government Employees Local 2284 sign a new three-year agreement as members of the union and management negotiating teams look on. The agreement, signed March 30, becomes effective April 15.

Students get chance to name new Orbiter

America's students will compete nationally to name the replacement Space Shuttle, scheduled to make its premiere flight in early 1992.

The new Orbiter, designated OV 105, is under construction by Rockwell International in California and is scheduled for completion in April 1991.

NASA, in cooperation with the Council of Chief State School Officers (CCSSO), announced the opportunity March 30, stating, "NASA's first Orbiters were named

after sea vessels used in research and exploration.... The tradition of naming an Orbiter after an exploratory or research sea vessel will be continued with OV 105."

The name chosen should not only identify an American spacecraft but also should capture the spirit of America's mission in space. In honor of the seven crew members lost in the Challenger accident, the name Challenger has been retired.

Entry packets will be available in early May. To enter, elementary and

secondary school students will form teams, research a name, and prepare a related classroom project.

There will be two entry divisions: kindergarten through 6th grade, and 7th through 12th grade.

Deadline is Dec. 31, 1988. Each state, territory and agency will announce one winner in each division in March 1989.

NASA will announce the final winner from each division and the name selected for the Orbiter in May 1989.

NASA Road 1 changes eyed

Relative to visitors center construction

(Continued from page 1)

Flight Education Foundation has commissioned an independent study of NASA Road 1 alternatives as they relate to the new visitors center and expects to see the results by the end of this month.

"We will continue to work closely with the state in order to assure the adequacy of highway capacity serving JSC during the construction process on NASA Road 1," McCright said.

The Foundation's board of directors has approved preliminary design plans submitted by Walt Disney Imagineering. Bob Rogers, the project's chief designer, is directing his team in the creation of an "experience center" where people can touch and feel the adventures of manned space flight "physically, intellectually and emotionally."

The new JSC visitors center is expected to draw at least 2 million people during its first year of operation, Stall said, an increase of about 800,000 over JSC's 1986 total of 1.2 million visitors.

Selection of architectural/engineering and construction firms to manage construction of the new visitors center began in February with requests for proposals. The Foundation board is expected to announce the winning construction management bid in May, followed by the architectural/engineering award in June.

Construction of the \$40- to \$60-million project is expected to begin in mid-1989 and be completed in late 1990. The center will be built on 40 acres inside and just west of JSC's main gate.



EVA RETRIEVER

As the Space Station crew member tightens the last bolt connecting the solar array to the trusswork, he loses his grip and a wrench begins to float away. He reaches for the wrench, but it slips through the gray fingertips of his gloved hand. The astronaut speaks:

"Retriever, quick-activate. Fetch wrench."

A small hangar door near the air lock opens, and a human-sized robot called EVA Retriever uses its modified manned maneuvering unit (MMU) to fly out of the hangar and around the trusses. Its tracking sensors and radar imagers lock onto the wrench. MMU thrusters fire rapidly. EVA Retriever avoids an orbital maneuvering vehicle (OMV) as it flies to the wrench, then reaches out with a robotic arm, and grasps it in a multi-fingered dexterous hand. The MMU thrusters fire in quick sequence again. Retriever returns to the waiting astronaut and performs station-keeping maneuvers.

"Thank you, Retriever," says the crew member as he grips the wrench. "Release and go home."

Retriever lets go of the wrench, and returns to its hangar.

Robot doesn't wag its tail, but boy does it fetch

By Kelly Humphries

Fetching a wrench may not seem like an important task for an autonomous robot, but what if the object drifting away from the Space Station were a crew member? What if it were the only replacement for a malfunctioning piece of critical equipment? Or what if the free-flying wrench were to collide with the Space Station on its next orbit?

A team of JSC engineers is developing a solution to the anticipated problem of accidental separation, a problem that is bound to be encountered when Americans are living and working in orbit continuously. The team already has put together a Phase I voice-controlled demonstrator that can use an MMU to move about on the air-bearing floor in Bldg. 9A, locate targets, distinguish between a wrench and an astronaut, reach for and grapple the target and return it to a "home" base.

The EVA Retriever, paid for through the Center Director's Discretionary Fund, is a joint project of the Engineering Directorate's Systems Development and Simulation, Crew and Thermal Systems, Tracking and Communications, Avionics Systems, and Structures and Mechanics divisions. Work began in November 1986 as an outgrowth of an earlier "Astrobot" proposal.

The current prototype, which made its debut before the national press this week, is a conglomeration of existing equipment and technology, much of it contributed by the divisions supporting the project. It uses Votan voice recognition and response, Remotec robotic arms, a three-fingered hand and on-board software developed in-house, an Odetics 3-D laser mapper, Inmos trans-

puters, Intel bit-bus interfaces, and a modified McDonnell Douglas missile-borne video tracker.

In Phases II and III of the three-year project, the team plans to enhance its test bed capabilities by improving the EVA Retriever's subsystems, progressively increasing its intelligent autonomous capabilities, and enabling it to avoid moving obstacles and retrieve moving targets. Once the ground demonstration program is finished, the next steps in the EVA Retriever's development would be to test it in simulated microgravity and in orbit from the Space Shuttle.

"The need," according to Gerald Reuter, manager of the ground demonstration project, "is that when astronauts are out working on the Space Station, there is a chance they might become detached and need a quick response system that can go out and get them."

The target also could be a valuable piece of equipment that's needed immediately to finish an EVA task. At a minimum, a crew member would have to return to the Space Station to get a replacement. At worst, the crew might have to wait for a resupply Space Shuttle from Earth.

"There's no Sears up there that you can walk down and buy a tool from," said Test Director Keith Grimm of the Systems Development and Simulation Division.

"The Retriever could evolve into an EVA helper," added Cliff Hess, the project's Crew and Thermal Systems Division engineer. "You can probably

get some real productivity gains, where you essentially have another EVA crewman out there, as opposed to a teleoperated system where you're probably going to tie up a crewman operating that system."

The team is also attempting to break new ground in robotics and artificial intelligence. Those areas were identified in JSC's Strategic Game Plan as important technologies for future space operations and exploration of our Solar System.

"If you think about it, we don't really have an intelligent autonomous system in place today, anywhere. This will be an attempt to provide such a system," Reuter said.

"This could really change the way people think about robots," said Kathy Healey, chief of the Intelligent Systems Branch.

"Twenty years ago researchers thought in 20 years we'd have totally autonomous intelligent robots. Now everybody has slipped back into teleoperated systems. If we could fly something in 10 years that was highly autonomous, it would make a big difference in the shape of robotics and the kinds of things people try to do with robots," Healey said.

"There's one group of people who think robots can do a lot more, and then there's another group that's saying robots can't do that much and you guys have really bitten off more than you can chew," she added. "We probably have. But it doesn't matter because wherever we end up we will be a lot farther along

than anybody thought we could ever get."

The biggest challenge of putting together the EVA Retriever prototype for ground demonstrations was getting the separate parts—the MMU, the arms, the hand, the tracker and the distributed software modules—to work together as one. The solution to integrating the robot was, ironically, people.

"As with any big project, requirements and specifications are interpreted differently," Healey said. "And then when something doesn't work, you get the people to sit down and talk it out and figure out where the differences are and then somebody makes a change."

In Phases II and III and beyond, the emphasis will shift to increasing the robot's autonomy.

"One of the major challenges is getting it to look at the environment and respond appropriately of its own volition—giving it the intelligence to make its own decisions," Grimm said. "The only thing you'll have to do in Phase III is tell it to go."

On the other hand, humans will need to retain control of artificially intelligent robots. Many science fiction stories have dealt with the need for "robot laws" that prevent autonomous automatons from harming humans through action or inaction, and the designers of the EVA Retriever are addressing those concerns.

"You do not want an autistic robot, you want a robot that will always respond to human beings," Healey said. "The effective way to do that is to always be able to intervene and redirect the robot or stop it dead in its tracks."



Above, EVA Retriever uses a 3-D laser mapper for depth perception when tracking targets. Different colors, shown above in shades of gray, show the range. At right, EVA Retriever demonstrates its abilities on the air-bearing floor in Bldg. 9A.



Roundup Swap Shop

All Swap Shop ads must be submitted on a JSC Form 1452. The forms may be obtained from the Forms Office. Deadline for submitting ads is 5 p.m. the first Wednesday after the date of publication. Send ads to Roundup, AP3, or deliver them to the Newsroom, Bldg. 2 Annex, Room 147. No phone in ads will be taken.

Property & Rentals

Sale: Algoa/Santa Fe, .5 acre, well, septic tank, water purifier shed, \$12,500. Linda, x33844 or 409-925-4862.

Lease: Colorado Springs, CO, 4-2-2, 2,800 sq. ft., 2 FPL, solar heat, avail. April 1. Rhonda, 282-3284 or 532-1497.

Sale: Big Bend, 160 acres hunting land, \$170/acre. 337-4051.

Sale: Clear Lake, Oakbrook, 4-2-2, pool, partially furnished, \$825/mo., x39800.

Lease: El Lago condo, 1 BR, 1 bath, mirrored walls, miniblinds, W/D, upstairs unit, 650 sq. ft., \$300/mo. Lindemann, 488-3300 or 532-2218.

Lease: Clear Lake townhouse, 3-2.5, no yard work, vacant 4/15/88, \$550/mo., deposit. 996-8240.

Sale: Friendswood/Sun Meadow Estates, wooded lot, cul-de-sac, bordered by stream, golf course, 210' deep, gas/elect. on site. Doug, x32860 or 486-7412.

Lease: University Trace condo, 1 BR, study, W/D, new carpet, paint, \$375/mo. Russ, x34742.

Sale: Friendswood, wooded lot, cul-de-sac, near schools, shopping, \$16,900 or \$195/mo. 488-3224.

Sale: Omega Bay, waterfront lot, all city utilities, R.R. bridge raised. 409-935-9250.

Sale: Horseshoe Lake Estates, 3-1, AC, furnished, 1 acre on small fishing lake, Trinity River. x33138 or 479-5594.

Lease: Crystal Beach, beachfront, sleeps 8, 2-bath, AC, families only. M. Edwards, 282-4017 or 488-2681.

Lease: Bacliff, mobile home lot, \$85/mo., \$50 deposit. 488-1758.

Lease: Bay efficiency cottage, adults, no pets, \$150/wk. or \$500/mo., \$100 deposit. 339-2450.

Lease: CLC condo, 2 BR, FPL, balcony, W/D conn., appliances, pool, storage, \$350/mo. 486-0315.

Sale: Lake Livingston lot, 160' x 50', all utilities, in Impala Woods, \$1,800. Doug, x39376 or 337-3704.

Sale: League City, 3-2-2, cul-de-sac, landscaped, low equity, FHA 10% fixed assumable. David, x35464.

Lease: League City, mobile home, 2-1, W/D connections, new carpet, carport, shed, \$250/mo. Scott, x37115 or 485-4364.

Lease: Marina Del Sol, 3.5-2.5-2, open design, 2200 sq. ft, 3 decks, landscaping, \$750/mo. Mike, x39812 or 334-0510.

Sale: Austin/UT condo, 1-1, assume loan, no equity. J. Craig, x33977 or 420-2936.

Lease: Galveston, 2-2, marina w/pool, \$500/wk.; weekend rates. Fendell, x31206 or 538-1147.

Lease: Galveston, Pirates Beach, 3-2, FPL, W/D, all appliances, \$100/night. 488-0667.

Sale: Medina Lake, open plan, 2nd level wood deck (3 sides), lake view, 30 min. San Antonio, \$60,000. Ben, x31588 or 488-1326.

Lease: Seafarer, 1 BR townhouse, attached garage, deck, FPL, vaulted ceilings, flexible lease, \$585/mo. Dave, 480-0298.

Lease: Galveston Bay, Victorian condo, sleeps 6, furnished, weekly and weekend rates. 480-5270.

Sale: Texas A&M, '77 mobile home, 14' x 65', 2-2, AC, new carpet, \$8,000. Doug, x33367 or 480-2929.

Lease: Lake Livingston waterfront, 3-2, furnished, pier, fishing, skiing, swimming, weekend and weekly rates. 482-1582.

Sale: Friendswood, big wooded lot, \$15,900. 488-3224.

Lease: Galveston/Jamaica Beach, sleeps 8, central air, city water, \$50 per day (min. 2 days), \$20 service fee. 337-3970 or 280-2493.

Lease: Clear Lake/Ellington, 2 BR condo, pool, can furnish W/D, upstairs and downstairs available, \$335/mo. Eric, x38420 or 484-9179.

Sale: Bar X, Angleton, 1.5 acre, low cost and assumable. Kaye, x37937 or 482-1317.

Cars and Trucks

'87 Dodge Custom Van, 318-V8, dual air, loaded, all power, 18.5K mi., ex. cond., \$17,500. Bryce, x36729.

'80 Mazda Coupe 626, blue, AC, 5 spd., AM/FM, good cond., low miles, \$2,300 OBO. Les, x38506 or 333-2846.

'84 Volvo DL Wagon, ex. cond., \$8,500 OBO. 337-3624 or 409-935-9274.

'78 Chevy Pickup, 1/2 ton 350 auto, PS, AC, AM/FM, new steel belt radials, \$1,800. Bill, x33210.

'77 Chevy Van, runs good, needs brake and body work, orig. owner, BO. J. Craig, x33977 or 420-2936.

'86 Olds Delta 88, 3.8L, V6, maroon, loaded, 28K mi., \$9,500 OBO. Ray, x30823 or 554-5434.

'86 RX-7, sports model, white, maroon interior, AM/FM, 24K mi., ex. cond.,

\$11,995. Jeff, x31493 or 996-7097.

'86 RX-7, 18K mi., 5-spd, AC, power sunroof, AM/FM/cassette, rear window louvers, silver/blue. 480-0907.

'81 Chevy Chevette, auto., air, AM/FM, ex. cond., 61K mi., \$1,900 OBO. 333-6449.

'86 Ford Truck F150, dark blue/tan two tone, standard cab, loaded, 28K mi., \$7,700. 335-1544.

'86 Cutlass Supreme, V6, cruise, tilt, PS, PB, AC, AM/FM, PW, white, blue Landau top, \$8,500. x39374 or 481-3953.

'82 Mercury Grand Marquis, 4 dr, loaded, orig. owner, service manuals, 85K mi., ex. cond., \$4,500. Ed, x39217 or 332-2041.

'67 Mustang, 3 spd., 289-V8, new paint, AM/FM, good tires, airshocks, headers, mags, AC, runs good, \$2,995. Mike, x38169 or 482-8496.

'84 Coleman "Sequia" popup camper, boat rack, canopy, outside stove, ex. cond., \$3,500. 482-3903.

'80 Olds Cutlass, V8, 2 dr, new tires, 70K mi., BO. Rick, x36156 or 480-1218.

'77 Suburban, new engine, \$2,000. 482-7176.

'83 Pontiac 1000, auto, AC, AM/FM, good cond., \$1,800. 332-8016.

'79 Pontiac Bonneville, PS, PB, AC, AM/FM, cruise, blue, good cond., 121K mi., \$1,000. Bill, x35421 or 482-7053.

'86 Camaro Iroc-Z, loaded, 486-5370.

'87 Nissan Stanza GXE, loaded, auto, 5 yr. 100,000 warranty, ex. cond., non smoker. Tony, 282-5550 or 409-935-1563.

'74 Chevy Nova, 29K mi., one owner, \$2,100. Owen, x36315 or 482-8660.

'84 Honda Accord LX, 4 dr, 5 spd., PW, locks, cruise, stereo, \$6,500. x30092 or 481-3637.

Lease: '85 Mallard 35' motor home, weekly rates. 337-4051.

Cycles

'83 Honda 1855 ATC, like new, \$775. 488-4412.

'85 Suzuki GS700E, 2500 miles, ex. cond., \$1,850. John, x36484 or 486-1186.

'83 Honda GL650 Silverwing, 4,800 miles, \$1,925 OBO. Jim, 335-8539.

'80 Honda 750, mags, low mileage, garaged, \$1,250. x30092 or 481-3637.

Boats & Planes

'85 Renken 20' power boat, sleeps 2, stereo, V6 OMC I/O, shorelander trailer, fresh water boat, 100% financing. Mike, 333-6821 or 474-4805.

Kadet Mark II trainer plane, remote control, new electric starter, Futaba 4 channel radio, accessories, \$175. x37149 or 409-925-2291.

'78 19' Wellcraft, 170 hp, Mercruiser I/O, S/S prop, 32 gal. tank, galv. trailer, stereo, \$4,500. x35178 or 944-2391.

Towing/sailing dinghy w/oars, sails, \$480. Jeff, x32725 or 532-1643.

19' Supercat catamaran, good cond., trailer, \$3,000. Bill, x36311.

Sunfish sailboat w/Dilly trailer, green and white, \$500. 332-3287.

16' V-shaped tri-hull ski boat w/ Mercury "1000" motor and trailer, needs work, John, x33120 or 554-4999.

'84 15' ski boat, 90 hp Mercruiser, trim and tilt, galv. trailer, \$2,500. Owen, x36315 or 482-8660.

15' Catamaran, galv. Sportsman trailer, new trampoline, \$1,000 OBO. Ed, x31927 or 554-6154.

Household

Bedroom set, full-sized bed, Montgomery Ward mattress, box spring, headboard, frame, drawer, mirror, night stand, \$250. Alan, 282-4120.

19" color TV, needs repairs, BO. Alan, 282-4120.

Whirlpool 17 cu ft refrigerator, freezer on top, green, good cond., \$75. Sears sewing machine, \$25. 488-5218.

Early American table & 4 chairs, \$200; Early American china cabinet, \$350; captain's bed, bookcase 7 6 drawer, \$300; gold framed mirror, \$40; roltop desk, solid pine, \$700, swivel chair, \$100, x36436.

Girl's French Provincial 5 pc. bedroom set, canopy bed, double dresser, night stand, desk, chair, off-white w/gold trim, \$250. 484-1820 or 282-3267.

Double cherrywood pineapple design bed with slats, no mattress or box-springs, completely redone, \$150. 282-4051.

Loveseat, pastel quilted print, peach, beige, brown, blue, lavender & mauve, \$50; glass/brass & white lacquer coffee & sofa tables, \$50. Debbie, x30966.

Solid oak bunkbeds w/mattresses, bunkie boards, ex. cond., \$395. Kim, x34824 or 554-2030.

Dining room suite, 5 ft. china cabinet, table, 6 chairs, 2 leaves, dark wood, good cond., \$600. 488-8379.

Floral couch, \$50 OBO, fireplace screen, \$35. Kaye, x37937 or 482-1317.

GE dishwasher, under counter, almond, good cond., \$140. Deena, x32427 or 338-2429.

Twin & king-sized beds, complete, roll-away w/o mattress, \$30, \$50, and \$10, respectively. Jean, x37535 or 534-4397.

Green plaid loveseat sleeper, \$75. Beth, x37081.

Audiovisual & Computer

Gemini 10X printer, \$175 OBO. Jeff, x32725 or 532-1643.

Sony MLV-1000 multichannel TV sound adaptor, decodes MTS format stereo and SAP broadcasts, built-in amplifier, left and right line input & output jacks, \$75. OBO, Mike, x38169 or 482-8496.

Gemini 10X computer printer, \$115; Memorex video cassette player, \$100; Magnavox VCR remote, audio dubbing, \$150. Dan, x30811 or 488-5471.

AT&T PC 6300, monochrome, 30 meg hard drive plus floppy, 640K RAM, \$1,100. Mike, x34378 or 486-4983.

AT&T 6300 PC, 640K, 2 drives, 1200 baud Hayes internal modem, Epson printer, monochrome monitor, software, \$975. Philip, x33213 or 996-7862.

GE handheld video color camera, \$250, ICOM 2 meter O2AT transceiver ham radio, \$250. Wayne, x34266.

IBM software, Multiplan, \$25, First Choice version 1, \$25, Commodore 64 joystick, \$15, Commodore 128 software, Timeworks Data Manager, \$15, Timeworks Partner, \$15, Manny, x37333 or 681-4126.

IBM PC XT, hard disk, color graphics, 640K, clock, serial/parallel, \$1,250. x30092 or 481-3637.

Want white twin day bed, mattress, box springs. Deena, x32427 or 338-2429.

Want to buy 1 ticket for EAA Bluebonnet Trail bus trip April 9. Susan, x31363 or 479-5594.

Want portable baby crib w/mattress, good cond., willing to pay up to \$30, also need play pen mattress. Laurie, x32426 or 996-8807.

Want Beta test site for 14 layer, autoplace, autoroute PCB artwork software. Bob, x38803 or 488-4453.

Want (2) 10 spd. bikes under \$25 each. Kam, x35159.

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American gray faced common boa, 4' long, \$50. Cherie Guillory, 488-2652.

Carpet, room size, \$25, large den size, \$35, brown and tan. 334-2335 or 282-3216.

Vista camper shell, gold/brown, fits Dodge/Ram D50, tinted sliding side window, ex. cond., \$200. Dahlia, x33759.

Sears Craftsman II lawnmower, 3.5 hp, 20" side-discharge, like new, \$115. Homick, x37108 or 486-8463.

High quality, unused water treatment unit. Darrell, x38515 or 332-1614.

Wooden secretary's desk w/typewriter extension, \$175, 2 black steel desks, \$50/ea.; 2 black office chairs, \$30/ea. 332-1377.

Hardwood office desk, 3' x 6', \$150, hardwood library table, 3' x 6', \$50, two door steel office cabinet, \$50. Fay, 337-4903.

Console B/W 23" antique style, \$80; woodframe sofa, \$100; two coffee tables, \$20/ea.; desk, chair, \$15/both; turntable, \$30; side tables, \$10/ea. Kam, 486-5247.

Bassinet, \$24; baby carrier, cloth liner, \$13. Karen, x32628.

Octagym, multi-rower, \$50. Mike, x34378 or 486-4983.

Push type lawn mower. 486-0111.

Edmund Scientific Telescope, 6 inch reflector, clock drive, 3 eyepieces, camera adaptor, \$300. 280-7408 or 333-9446.

Baby furniture, Simmons crib, mattress, Strolee playpen, retail \$554, BO. 870-0990.

High-heeled tap shoes, size 5-1/2 or 6. Saundra, 333-2273.

3 custom made decorative ladders, 18" wide, \$10. Ed, x34244 or 471-2542.

Cobra radio, 40-channel base plus sideband mobile, \$300. 947-9755.

Commodore Vic 20 keyboard, \$75; girl's white rattan dresser, \$20; Beta VCR-Sanyo, \$150. x34252.

Singer sewing machine, model 604, wooden cabinet, \$125; large ventilated motorcycle helmet, \$75; inversion table, \$35. x30145.

J.C. Higgins persimmon woods, nos. 1, 2, and 3. Reg pro-line shaft, good

cond., \$45. Frank, 282-3858.

VW type 1 engine, parts, doors, gas tanks, wheels. Ray, x30823 or 554-5434.

Tires, 195SR70-14, Kelly Charger, raised white letters, \$100. 474-3651.

2 Stearns ski vests for small adult, new, \$17/ea.; Sears light duty 3/8" drill press, \$45. Manny, x37333 or 681-4126.

Aluminum running boards, splash shields for pickup truck, \$35, Litton microwave, \$40. x39374 or 481-3953.

Pink prom dress w/accessories, size 7, was \$200, now \$50, ex. cond. 479-7171.

Cordless phone, Uniden EX3000, autosecure, redial, paging, mute, adjustable volume, make offer. 870-0990.

Free TV console set if you will move replacement TV by pickup truck from another location. 488-8273.

Dome type hair dryer, \$20; antique table, \$75; speed reader, \$10; exercise bike, \$100. 488-8273.

Twenty-one unframed, signed and numbered Dalhart Winberg paintings, will sell separately or as a set. Tom, 332-3125.

Pickup camper top, fits small standard beds, full windows, aluminum, white. Bob, x32193 or 332-3817.

Gottlieb "dancing lady" pinball machine, \$165; work bench w/light, \$25. Sue, x33037.

Weaving loom, 2-harness maple, 36" wide, \$250. Joyce, 488-3988.

